Promising approaches to enhance SAGD performance in uneconomical tar-sands

Abstract :

Low permeability, shale barriers and low thickness are the main issues making significant portion of the immense heavy oil and bitumen resource uneconomical to produce. Two main troublesome cases were investigated in this study to address by applying appropriate solutions in SAGD process; firstly reservoirs with shale barriers and low permeability and secondly thin reservoirs. In cases of low vertical permeability due to shale inclusion in the reservoirs, the effect of induced vertical fracture resulted in faster upward steam chamber expansion and increased oil recovery rate. Sensitivity analysis showed higher well spacing is beneficial to the process while applying the induced vertical fracture. In thin reservoirs, steam chamber reaches overburden faster and increases cumulative steam-oil ratio (cSOR), hence making recovery processes uneconomical. Appropriate placement of Induced Horizontal-Fractures (IHF) and off-set vertical wells with the later being in halfway of two adjacent horizontal well pairs in SAGD and acting as a steam injector was applied. The results showed such applications reduce cSOR. Found from the sensitivity analysis, Induced Horizontal-Fractures positioned in the injector and the producer place improves oil recovery in thin reservoirs. When applying the fracture just in producer location, the oil recovery result is superior to the former case. In fact, IHF provide a path facilitating the oil drainage to producer that leads to faster oil transportation. The Off-set vertical well in the thin reservoir sweeps a part of the reservoir located beyond the chamber edges of two adjacent well pairs, hence reducing recovery time and cSOR. Based on sensitivity analysis, the most promising result of the process is achieved when initiating steam injection in the vertical injector from the beginning of the process.